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PLUMBING CODE AND CONTROL OF PLUMBERS[1]

SCOTLAND G. HIGHLAND[2]

The object of this paper is to show that the character of private plumbing installations and the control of plumbers are matters of vital interest to water works operators; and that the responsibility of water works officials does not cease with the delivery into the street mains under adequate pressure of a clear, germ-free, wholesome water.

The water department, knowing intimately by its own investigations and by chemical analyses the character of water supplied to consumers, is in the best possible position to give advice regarding the material suitable for supply pipes.

The amount of water to be supplied at the source is always greater than that actually needed for use. There is leakage from the service pipes, and from a considerable percentage of the plumbing fixtures in the houses, and water is allowed to run uselessly from many openings. In many cities four times as much water is supplied as is actually used. The greater part is wasted without benefit. It is mainly for this reason that the control of plumbing and plumbers by water departments is absolutely essential. The unnecessary draft of water from fixtures may be checked by universal metering and the adoption of a schedule of rates by which the payment of takers is dependent upon the amount of water passing through the meters.

A comparatively small percentage of services are metered, however, and we must deal with the problem as it exists.

The official inspection of plumbing work in cities of the United States began about the year 1881. In this year, too, the first complete plumbing code was adopted and among the cities leading in this movement were Lawrence, Massachusetts, Washington, D.C.,

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[1] Read at meeting of American Water Works Association, May 9 to 15, 1915, Cincinnati, Ohio.

[2] Secretary and general superintendent, Clarksburg water works and sewerage board, Clarksburg, West Virginia.

New York City, Brooklyn, New York, and Chicago, Illinois. The official control of plumbing work had for some years previously been agitated and urged by health departments and by persons interested in house sanitation.

It was but natural that the first codes were enacted and enforced by health departments. Later on, this work was shifted over in some cities to the municipal building bureaus. It was claimed by some that it was more logical to include the duty of plumbing inspection with the numerous other functions of building departments, and practical advantages as regards the filing of plans in particular, were claimed for the change in departments. Still even at this day the control of plumbing in the majority of cities, which have enacted a code, is in the hands of the health commissioners or their assistants, and this is due to some extent, no doubt, to the popular belief that there is some connection between bad or imperfect plumbing and disease.

In more recent years, some of the states have enacted laws, providing for the local control of plumbing, and have issued general rules for plumbing and water supply.

Not only the large cities of the country, but many smaller cities, towns and villages have adopted plumbing codes.

The more concise, comprehensive and brief a plumbing code, the better will it fulfill its purposes. Clearness of wording is essential. Each paragraph, each rule should be definite and there should be no doubt left as to its proper meaning. No arbitrary interpretation of a rule by the plumbing inspector should be possible.

WHY ARE PLUMBING CODES REQUIRED

The writer is a firm believer in the good results which are brought about by the enactment and enforcement of plumbing codes. He has noted the vast improvements which have taken place in the past ten years in the character of the plumbing work as executed in all classes of buildings, and he can unhesitatingly state that these improvements are due, perhaps more than to any other cause, to the introduction of an official and honest supervision of plumbing by municipal authorities, or by water works departments.

In these years the art and craft of plumbing have made wonderful advances and credit for this also belongs, no doubt, to respectable and first-class plumbing firms to be found in every city or town, and to the local and National Associations of Master Plumbers. But as in every herd of white sheep there may be found some black sheep, so there are plumbers and plumbers, and it must be said, sad though it is, that some men of the trade do not know, or if they know, do not wish to carry out a contract honestly and creditably, whenever there is a chance to "scamp the job." Therefore, to prevent imperfect work, plumbing must be inspected. The best men in the trade do not object to such inspection. It rather protects them against unscrupulous competitors. House owners, as well as tenants, should likewise welcome the introduction of a code, for it secures to them good and reliable work, and protection against leaks or other plumbing troubles.

Every plumbing code should require that all persons working at the business of plumbing, whether as a master or as a journeyman plumber, should have a certificate of competency, and should be registered.

To establish such competency and registration every code provides a board of plumbing examiners, before whom applicants should appear for examination, and who determine their qualification to engage in such business.

The board of plumbing examiners should consist of at least three, and preferably five, members. One of these should be a master plumber, another a journeyman plumber, both to be appointed for one year by the mayor, under approval of the city council. The other members should be city officials, preferably members of the water and sewer departments or the city engineer's bureau. The board should hold regular business meetings, institute the examinations, and issue licenses to the successful applicants. The secretary of the board should keep all records, books, plans, specifications and other papers, and should preferably be a municipal officer, or he may be the superintendent of the water department.

All licensed plumbers must be registered and should be required to execute a bond for the faithful performance of their work, the amount of the bond varying from $500 to $3000, according to the size of the city.

With the single exception of repairing leaks, all plumbing should be done only after filing plans and specifications and obtaining a proper permit from the board.

The board should appoint the plumbing inspectors. They should be selected only with reference to their fitness for the position; political favoritism should be excluded. Only by a strict adherence to this rule can an efficient corps of inspectors be maintained.

When the plumbing work in a building has been completed, tested, and inspected, the board issues to the plumber, upon his request, a certificate of inspection that the work has been properly performed as required by the provisions of the code. To make such a certificate of value to the owner of a building, it should have the signature of the plumbing inspector and of the superintendent of the water department.

WHAT CITY DEPARTMENT SHOULD CONTROL PLUMBING

The writer has already mentioned that inspection is carried out either by boards of health, or by building departments. There are, however, other municipal departments, who are interested in the plumbing code, namely: the water works department or board, the sewer department or board, the city engineer's or city manager's office, and the fire department.

There is much to be said in favor of having the plumbing controlled by a water works department, as is at present the case in Clarksburg, West Virginia. A good plumbing code is of inestimable importance to a water works department. The absolute control of plumbers is quite necessary in order that the house installation may be of a satisfactory character. This control also consists in obtaining proper reports on this installation for filing in the water department's office.

In England, for instance, the various private water companies have each its own set of very complete regulations as to the thickness, weight and quality of pipes and fittings to be used for service supply.

WHAT POINTS, BESIDES THE GENERAL ONES MENTIONED, SHOULD A CODE EMBRACE

The following are some of the essentials:

(a) It should specify the use of proper plumbing materials and require first class workmanship.

First class work implies both good materials and a careful laying out and carrying on of the work.

(b) Safety requires of the entire work freedom from leaks in supply pipes.

(c) It should strive to introduce safer, simplified and more economic plumbing systems and layouts.

(d) It should consider the possible relation between plumbing and preventable disease.

(e) It should provide proper material and sizes of service and house supply pipes, and thus insure a sufficiency of wholesome hot and cold water.

(f) It should provide proper, strong and desirable water fittings, faucets, ballcocks, tanks, etc.

(g) It should make provision against both waterhammer and noise in the house service pipes.

A good mechanic knows how to guard against waterhammer in a supply system. The entire abolishment of noises in the water pipes, boilers, and in flushing tanks is desirable, but not always easy to attain.

(h) It should guard against the freezing of water pipes and also efficiently prevent any undue waste of water.

The last two requirements are of so much importance that they will be dealt with at length further on.

In addition to the above, the plumbing code should provide that none but tappers employed by the water department should be permitted to tap any street water main.

The work of efficient municipal or private water works should not be restricted to the routine duties, which consist in providing in the city service reservoirs and in the city water mains a wholesome, germ-free supply of clear water.

Such bureaus should always have a higher aim in view, namely of having a perfect control of the supply at the house faucets, in the house storage tanks, in the basins, bathtubs or other ablution fixtures, and even of the drinking water at the consumer's table. The water delivered to the consumers should be without color, bad odor or bad taste, and free from deposits of sediment or rust in the house pipes.

Moreover, a matter of vital interest to the water department, and no less to the taxpayers, is the prevention of all unnecessary *waste of water*. This matter becomes serious, where, owing to droughts, there is a threatening shortness in the public water supply. Can it be efficiently accomplished, and if so, by what means?

Efficient water works departments have learned to cope with this question in street mains, but they should go a step further and strive to prevent waste of water from consumers' fittings and in water takers' premises. To the average layman a slight leakage seems an unimportant matter and he is apt to overlook the fact that the effect of slight leaks, if constant, is vastly increased by the time factor. A mere dribble from a faucet, if allowed to run on unchecked for twelve months, often amounts to more than the annual tax for water. In cities and towns, where the unrestricted constant supply system is used exclusively, it is of the utmost importance that the waste be checked, however unpopular or unpleasant the application of waste-preventing measures may appear to be.

The existing water pressure has a considerable bearing upon the volume of water running to waste from defective fittings, and this is another point ignored by water takers.

While waste of water due to badly constructed apparatus, or fittings, or to defective workmanship can and is prevented by the department's plumbing supervision, where the department has the power to regulate by code the character, strength and arrangement of pipes, faucets, tanks, cisterns, fittings, boilers and plumbing fixtures, much of the waste going on in buildings is under direct control of the consumers. This refers not only to waste caused by faucets carelessly left running, but also to the waste due to *wilfully* keeping faucets open. Then we have another waste, due to running water off from the hot water faucet in cases where a circulation pipe is omitted; still another is the wilful running of faucets to get, in summer, cool water for drinking; sometimes it is caused by a cold water pipe being in contact with hot water or steam pipes or by its being carried near a kitchen or laundry ceiling, where much heat accumulates.

Consumers are likewise responsible for hidden wastes from underground service pipes which have become corroded or broken. Then there is the waste due to ordinary wear and tear, caused for instance by worn-out washers in faucets or tank ballcocks.

Fittings in private houses are much more difficult to control than those in public or semi-public buildings. Hence the water department should have proper authority to enforce a penalty for neglect of the water fittings, and also for wilful waste. In many cities and towns this is quite a customary measure of prevention.

All well-organized and efficient municipal or private water works departments issue a set of rules and regulations governing the use of water. These rules should be explicit and they must be impartially enforced. Some of the points to be covered by the rules are:

Taps and service pipes to be of size prescribed by the water department. They shall be run into the buildings only by licensed plumbers, who must file an application stating the material to be used. The connection to be inspected before being covered up to guard against poor workmanship or imperfect fittings.

All water takers are required to maintain the entire inside water system in good condition and repair. They shall also protect all pipes and fixtures from freezing.

A further precaution to prevent waste of water consists in the annual inspection of all water fittings by water department inspectors.

If space permitted, the speaker could take up numerous details regarding the water supply of buildings. Suffice it to mention but a few points.

In some English towns (like Manchester and Liverpool) all water fittings are tested and stamped by the water departments and only stamped fittings are permitted to be used. In our own country such a far-reaching control or discrimination is neither practicable nor desirable, but owners of houses should be cautioned, in their own interest, to specify or purchase only fixtures and fittings made by manufacturers of first class reputation. The difference between such fittings and cheaper ware is usually but slight, whereas the cost of removing and renewing fittings, which turn out to be defective and unsatisfactory, is considerable.

The examination, licensing and control of plumbers who wish to do any work—contract or jobbing, new work, alteration work or repairs—in connection with the water works system of a city or town, are matters of vital importance to a water department. To exercise such control without, in some cases, some friction being created is not always easy, but much can be accomplished in this direction and trouble and misunderstandings avoided by a firm and tactful conduct of the men who comprise the board.

It is decidedly to the interest of all water works plants that permission should be obtained to do work in buildings. The systematic filing of plans, of the specifications, of the record plans, showing the location of the fittings, and of diagrams, giving the number, style or type, size and material of fittings acts as a decided measure of protection to property owners. It should, therefore, be universally encouraged.

The plan which has been adopted and which is being carried out by the water works and sewerage board of Clarksburg, West Virginia, to license and control all plumbers is a thoroughly good one, and the measure is a just one, protecting as it does the water department, the conscientious and honest plumber, the realty interests and the owners and tenants of the buildings.

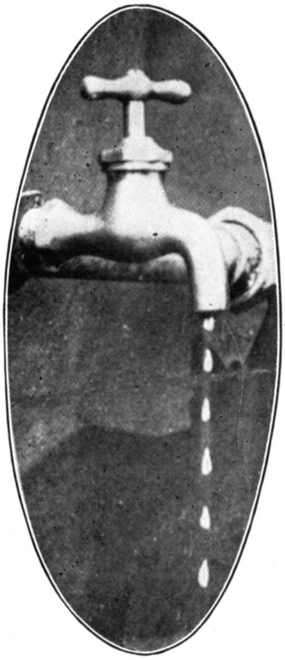
Some water works plants, even those where the water is purified by filtration on a large scale, fail to give entire satisfaction, because of troubles existing and persisting from the point where the water leaves the main until it reaches the consumer. Under such conditions arise numerous troubles and complaints of the water takers.

It is the business, and the duty of a progressive, broad-minded and public-spirited board to thoroughly investigate each complaint, no matter how trivial it may appear to be. Occasionally the consumer finds it necessary to complain of dirty water, and this may be caused by accumulation of deposits and rust in old, worn-out services, which cause the benefits due to the filtration plant to be lost, though there may be other causes.

The Clarksburg water works and sewerage board instituted last year a very excellent plumbing code embracing all safe and established methods of supplying water to buildings and generally all classes of work usually done by plumbers, a copy of which was furnished to every water works department in this country and Canada.

A water works department may control some of these points, and in others it can do much to retain, or regain, the confidence of the water consumer by practical advice and by intelligent and prompt action in remedying the troubles complained of.

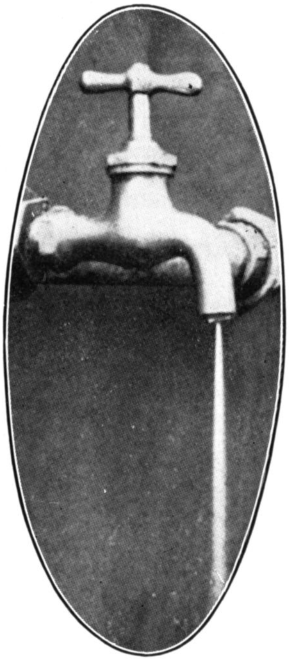
Water pressure 105 pounds per square inch. The price per 1000 U. S. gallons, 25 cents.



WATER JUST DRIPPING

15 gallons per day.
105 gallons per week.
5,475 gallons per year.

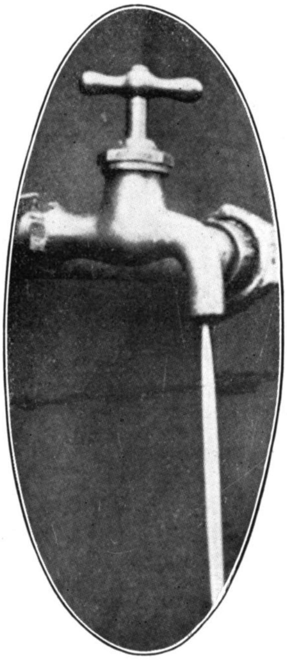
Cost per day......	$0.00375
Cost per week.....	.02625
Cost per year.....	1.36875



WATER LEAKING THROUGH ONE-SIXTY-FOURTH OF AN INCH APERTURE.

98 gallons per day.
686 gallons per week.
35,770 gallons per year.

Cost per day.........	$0.02
Cost per week........	.17
Cost per year........	8.94



WATER LEAKING THROUGH ONE-THIRTY-SECOND OF AN INCH APERTURE.

543 gallons per day.
3,801 gallons per week.
198,195 gallons per year.

Cost per day.........	$0.14
Cost per week........	.95
Cost per year........	49.55

SECTIONS OF PIPE SHOWING SOME CAUSES OF WATER WASTE AND REDUCED PRESSURE

These illustrations show only a few of the many causes of the waste of water, as well as the reduced pressure resulting from the bad condition of service pipes and house fixtures.

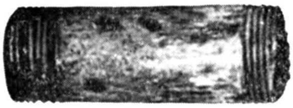


FIG. 1. THE EFFECT OF CORROSION ON BLACK IRON PIPE WHICH HAS BEEN EATEN THROUGH

This is a very common form of leakage.

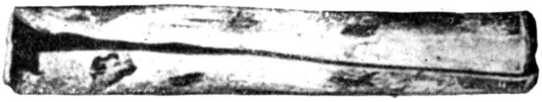


FIG. 4. IRON PIPE DAMAGED BY UNEQUAL SETTLEMENT.

In this case the fracture is longitudinally along the seam and readily admits of large leaks.

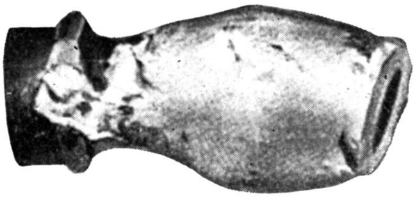


FIG. 2. A LEAKING WIPED JOINT

Due to poor workmanship.

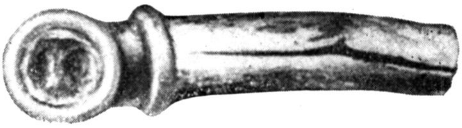


FIG. 5. COMBINATION OF CORROSION AND LEAKAGE.

This one-half inch pipe is so corroded that the opening would scarcely admit of a very small stream.

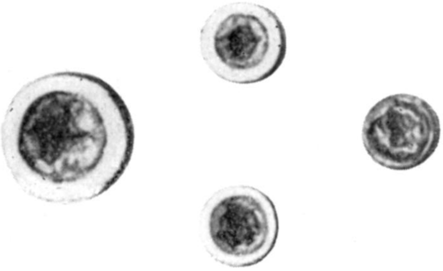


FIG. 3. EXAMPLES OF BADLY CORRODED SERVICE PIPES.

It frequently occurs that the failure of water to reach the third or even the second story of a building is caused not by lack of pressure in the street mains, but by corroded service pipes.

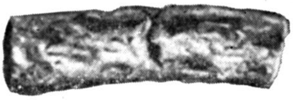


FIG. 6. THE EFFECT OF ELECTROLYSIS ON LEAD SERVICE PIPE.

The lead has been eaten completely away in one place, permitting a considerable leak.

In consequence of corrosion and leakage, cases are frequently found where the pressure on the street main as taken at the hydrant, is 100 pounds and that on the first floor of an adjacent dwelling is only 3 or 4 pounds. This condition when discovered can be corrected only by replacing the old service pipe by a new one. It can be prevented to a great extent when the service is first laid by exercising care in the selection of materials used and by procuring good workmanship.

DISCUSSION

Mr. George Houston: Mr. President, in cities where most of the water used is used without being metered, the advice and recommendations contained in this paper are very good and opportune. The speaker has had several years' experience in this way of furnishing water, and all of the troubles mentioned therein are very real. In order to get away from them, we adopted the general metering system, and our troubles vanished. It was found that notwithstanding all of the rules recommended in this paper, the waste of water went on just the same. Inspections following inspections, a month apart, three months apart, six months apart, and sometimes immediately after making the inspection, have found the parties using water wasting it just the same, or permitting it to run from the faucet to cool ginger ale, as has been mentioned here, in summer, or refrigerating anything that they wished to keep cool. Those in charge of the premises would promise not to do so any more, but have been found inside of twenty-four hours doing the same thing again. In order to stop water waste in that way it would be necessary to have a man on the job all the time. There is no other way to stop it. The only thing that is on the job all the time to look after waste is the water meter. If all of the cities or water companies that are troubled with the sort of complaint mentioned in this paper would adopt a general metering system they would do away with very much of their trouble in that line. We are not worried in our city to any extent about any water going to waste.

In one case where we had a consumer that we thought was using more water than he should under flat rates, we raised the assessment, and he came down and swore off a number of charges that we had made against him, and of course his oath had to be taken and a reduction made in the items charged for. Shortly after that took place the speaker prevailed on the water board to give us authority to install a meter on the premises at the city's expense. The party was away at that time on a vacation and there was nobody around the premises but the hired help. We installed the meter at the curb line, and the first month after that his water bill which had previously been about $8 semi-annually was $14 and some cents for the month. That was the result of the installation of a meter. One of our leading physicians who was paying $6 semi-annually objected to that rate, and the rate was cut down to $4. We put a meter on his premises immediately after that, and the first month his bill was $14.

Those are two cases, but a great number similar to them could be enumerated. The speaker is a member of our board of plumbing examiners and has been since its organization. We do not attempt to control the plumbing inside of the house, except as may be necessary from the standpoint of health, namely, with reference to sewerage plumbing. We have never attempted to have anything to say about the plumbing arrangements in the house otherwise. We put the water service in up to the curb line. The property owner through his licensed plumber takes out the permit and goes on into the house with it. We simply require that the city shall be secured against any waste or leakage that is the fault of poor plumbing in the premises by having a meter placed there by the property owner. We require plumbers to give a bond, not for the work done inside of the house, but simply to protect the city against accidents occurring through neglect to properly perform his work in the street.

Mr. A. A. Reimer: The paper as a whole is an excellent one and a timely one for us to consider. The point mentioned by the last speaker is one to which we can all give a great deal of thought, namely, the necessity of the control of fixtures inside of buildings, whether that should be done through the board of health or the water department or any other special department. The speaker's own feeling in the matter is that what is generally included as the sanitary plumbing should be directly under the charge of the board of health, because that is the only point where the health factor enters in. It is best to strengthen the powers of the boards of health at all times; by all means let them have the control of the sanitary plumbing.

The rules laid down for governing plumbers as outlined in the paper are accepted as good practice and represent the requirements of examination and licensing that are pretty commonly used.

We go a little further in our own practice in requiring that every employee of a licensed plumber shall have a card of identification on his person at all times during working hours, so that we may be sure that no employees are working except under license issued by the department. We have a provision that a licensed plumber may lay service pipe from the curb line into the house; but we require that such work shall be inspected at a nominal charge by ourselves. The fact is that in all the years that we have had that provision, no licensed plumber has ever taken advantage of that permission. We do all the work from the main to the curb, and we can do it so much cheaper than the plumber, that is, cheaper to the consumer or to the owner than the plumber, that we are not troubled by ever having to inspect pipes laid in streets by licensed plumbers.

The question of leakage in house fixtures became a very serious one with us. Five years ago we made a pitometer survey of the entire city so far as the mains were concerned. After having proved definitely that the leakage in the system of mains comprising nearly 80 miles was almost negligible, we carried the inspection farther, putting the same survey on, and demonstrated absolutely that 54 per cent of the leakage which was disclosed by the pitometer survey was traceable to the house fixtures. There was a very small amount in the mains but a very much larger percentage in the house fixtures. That was the beginning of a campaign to eliminate this heavy amount of leakage, and from then on we have been metering rapidly.

Probably we have all had the experience of having a licensed plumber tell some of our customers, in case of a high bill, that it was impossible that the customer could have used that amount of water during the length of time covered by the bill; that it could not possibly pass through the meter; that the meter is wrong. Now we have not been at all bashful in our remarks about plumbers who were telling our customers that. We have simply said in so many words without mincing matters, that the plumbers did not know what they were talking about. We are gradually making the plumbers come to time on that, and we have found that they do not know very much about the quantity of water that will pass through a given size of pipe. We are getting fewer and fewer of those complaints; but there are still some plumbers who think they know more than any water department can show them in regard to the amount of water that can pass through certain pipes under certain pressure. Our men are trained to find leaks on the customer's line. When we have trouble through the agency of the plumber telling people that there is no leak in certain premises, we go there and show them the leaks.

Now the speaker believes in the control of the plumbers, and when we find that a certain plumber has reported that there is no leak we get after that man and show him how to detect leaks in the right way; so that gradually that trouble is lessening.

Mr. Highland has stated that taps and service pipes should all be of the size prescribed by the water department. That is all right. Then he says that they shall be run into the buildings only by licensed plumbers who must file an application stating the material to be used. That provision is unwise to be worked into any plumbing code in the country. The time is coming when more and more of the departments and companies supplying water will insist on carrying supplies from the main to the meter point. If you have the meters at the curb line, that is all right and very easy; but the majority of us do not stop at the curb for metering, we go on into the house and set the meter in the house or the factory or whatever it may be. You do not find any gas company that allows a licensed plumber to lay any part of their services into the house; you do not find the electric light companies allowing some contractors to run wires up to the meter from a given point out on the feed line; and there is no difference in that regard between water, gas and electricity. We must stop this practice of allowing licensed plumbers or any contractors to carry the water from the main. By our carrying the services all the way into the house or building, whatever kind it may be, we have eliminated much of these troubles that are complained of.

The speaker wants to agree with the last speaker that his entire paper points to the need of meters; and when we have meters on 100 per cent of our total services we will find that we will need just a very few simple, effective rules to govern this whole situation and not an elaborate plumbing code.

Mr. A. Prescott Folwell: In regard to what the last speaker said as to the desirability of having the plumbing run all the way into the house by the city, the speaker understands that the code of rules suggested here would have the city run the plumbing to the curb; but thinks the idea of both speakers was to have the city run the pipes to the meter box; it happens, however, that the writer of the paper lives in West Virginia where his meters are placed at the curb, and the last speaker lives in New Jersey where the meters are placed in the cellar. Probably they agree that the city should run the pipe to the meter wherever it is placed, and the private plumber run it from the meter to the fixtures.

Mr. J. N. Chester: The inquiry will naturally come from private companies, as to who is going to bear the expense of running to the curb, or who is going to bear the expense of running to the cellar? If the water company lays the pipe into the cellar, who is going to stand the additional cost? The rates that must be charged either by public or private water works are in justice predicated on the investment, and if the services are run into the cellar at the expense of the plant it will mean an additional investment equal to the amount that either the city or the private company must pay in so doing.

All of these things must be taken into consideration with reference to the return the ownership gets from the investment, whether it is a private company or a municipal corporation. Another thing that has interested the speaker in this paper and in the first speaker's remarks is in regard to the amount of water that is not accounted for. There are various estimates made as to what this amounts to, and that is the thing that has interested the water consumption committee and that we endeavored to get at; the one thing regarding which we would like to see some data brought out in this discussion; that is, if it is not too far afield from the character of the paper.

Mr. Theodore A. Leisen: There are several questions in this paper that the speaker thinks are worthy of very serious consideration. The inspection of plumbing generally would, in the opinion of the speaker, be better left to the boards of health or such other parties as may control it. Where there is a sewerage board it might be very appropriate for them to inspect all plumbing; the inspection of the water pipes unquestionably ought to come under the water board or water department, and in that inspection for the protection of the water board or department it is essential that they should determine the size of the pipe not merely from the main to the curb, but also at least through the lower portion of the house. Many superintendents have probably had experience with complaints from lack of supply in the upper stories of houses. The water department is almost invariably blamed for not furnishing a proper supply, when in most instances the trouble is due to the fact that the pipes leading through the basement are too small to supply the number of headers running to the upper stories. That is one point that the inspection by the water department ought to cover.

We all recognize that the question of leakage would be largely controlled by the universal adoption of meters. If metering were universally adopted the waste would not be a matter of very serious consideration to the water department, unless it was deficient in the source of supply. Consumers should only use the water that they require for legitimate purposes and not allow it to run to waste.

The paper as a whole, in some points goes rather too much into detail as to the method of carrying out the suggestion and rules; that should be left in rather more general terms than it has been in this paper, because of the varying conditions in different localities.

Mr. F. J. Connor: Will Mr. Reimer please state what kind of services they use; are they lead?

Mr. A. A. Reimer: Our practice has been for small services up to 1-inch tap, to lay heavy lead pipe from the mains to the curb line, and there change to galvanized wrought iron pipe of the small sizes, and use wrought iron all the way through, the very highest grade of pipe that we can get.

Mr. F. J. Connor: How do you handle your consumers? Do you make them put up a deposit? Have you a schedule of cost that covers the whole service from the main to the curb along the short side of the street? Or do you figure from the short or long side of the street?

Mr. A. A. Reimer: East Orange is a municipal department, not a private water company, supplying the city. We have a set of rules governing all those matters. We require what might be called a "permit fee," and we make no charge for the tap or supply pipe as we call it from the main to the curb. From that point on we charge a given price per foot for the amount of pipe laid, so that a man away back from the street further than some one else pays no more to cover the additional distance. They pay a unit price per foot for the service pipe from the curb line into the building, varying with the size of the pipe.

Mr. F. J. Connor: In other words, the service from the main to the curb is free service?

Mr. A. A. Reimer: We charge the consumer nothing for that. We do not consider that the permit fee paid covers the cost of the service from the main to the curb. We charge that to capital account.

Mr. F. J. Connor: In that case the fee that you charge practically covers the cost of the service, so that in reality it is not a free service?

Mr. A. A. Reimer: We do not consider it as in any sense a permit for the service. We capitalize our connections from the main to the curb, and the fee paid is purely a license fee, that is all, and it is so regarded in our finances.

Mr. F. J. Connor: Until about one year ago the city of Sioux Falls determined to put in the service from the main to the curb free of cost. A legislative act was passed and now we charge from the main to the curb the actual cost. Of course labor conditions and the condition of the soil and all that make a difference in the cost; but we only charge actual cost. It was found that in many cases those who ordered services put in failed to pay for the same promptly and the commissioners, finding that there was an accumulation of such accounts, that people were slow in paying for services, took up the question as to whether we would continue to put in the services in that way or whether the applicants should be required to put up a deposit at the time they made their application. Now we have a law in reference to city improvements, such as paving and other street improvements, and we are trying to get away from all of the old galvanized services. We had two water companies in Sioux Falls, and where we cut off from the old company mains and connected to the new company ones on one side of the street we would extend the service to the new main, and on the other side we would cut it and connect to the other main which, of course, crossed. We have services that are probably twenty years old. We have passed an ordinance and are trying to persuade the people to put in all lead services from the main to the curb.

We have had some trouble with complaints of short supply through the party putting on a smaller meter than the service called for; for instance where the consumer had a $\frac{3}{4}$-inch service he would only want to put on a $\frac{5}{8}$-inch meter. The only remedy for that was that we would ask them to put on a larger meter when the service was of sufficient size, and convinced them that it was the meter, and not the service that was at fault. The service question is one that is confronting the speaker, who has been a plumber a good part of his life, but does not like to fall into the hands of every plumber, because a lot of them are not good lead workers. We use wiped joints, and if those joints are badly made and a leak starts, of course, the superintendent is called out of bed at night to look after the leak. You do not have any redress from some of those plumbers because they are irresponsible. The departments or water company ought to maintain and take care of the service from the main to the curb line, and that is as far as they should go; from that point you should turn it over to the property owner. Another method of putting in services is to do it by contract, and advertise for bids for the excavation and all. We charge $3 for a tap and then insist upon our men laying the service and seeing to it that the work is thoroughly done.

Mr. J. N. Chester: The speaker would like to ask Mr. Reimer whether all of his services are metered?

Mr. A. A. Reimer: No, sir. We have about 65 per cent metered and in another two years we will probably have 100 per cent metered. In the great majority of cases we set the meter inside of the basement of the building. In a few cases we are forced to set them at the curb.

Mr. H. B. Morgan: If you set the meter in the basement why did you change from lead at the curb?

Mr. A. A. Reimer: The primary reason was the element of cost; the other is the element of larger flow. The cost of 1-inch galvanized pipe, of the very highest grade is only about one-half that of lead pipe, say of $\frac{1}{2}$-inch in diameter. In our case, we have to use AAA lead pipe on account of our pressure. If we use $\frac{1}{2}$-inch pipe all the way through from the main to the building we are introducing a very large friction element which we can avoid by increasing the $\frac{1}{2}$-inch lead pipe up to 1-inch galvanized iron pipe at the curb and give the consumer a very much freer line conducing to a better flow of water.

MR. H. B. MORGAN: Do you feel that the board or company is fully protected from leaks when using galvanized iron pipe?

MR. A. A. REIMER: We have been in very close touch with the wrought iron pipe question owing to the fact that the speaker has been on the committee that has been taking up the question of wrought iron pipe, and feels that he is in a pretty safe position in specifying wrought iron pipe, since he knows what he wants and knows how to get it too. Specify nothing but strictly genuine wrought iron pipe; it is to be had if you want to get it.

MR. H. B. MORGAN: Those of us who are not so well versed in pipes as the gentleman who just spoke, perhaps might be fooled as to whether the pipe was galvanized iron or galvanized steel. There are perhaps not a dozen men in this hall who can tell the difference between the two. The speaker knows he could not, but he does not claim to be an expert.

The speaker cannot see any very good logic in requiring lead pipe from the main to the curb and allowing wrought iron pipe to be installed from the curb to the building where the meter is placed in the cellar. If the meters were placed at the curb it would make very little difference to the water company or the water board whether the pipe from the curb to the building was iron or lead, for the meter would register the leaks. Our company requires that all pipes of 1 inch and less, where laid under the ground or floor of a building, shall be extra strong lead pipe. We also require plumbers to leave the ditch open so that we may inspect the pipe after it is laid. This is done for the protection of the consumer, as well as the company.

Recently a meter was set at the curb on a service supplying a building with a single fixture, a kitchen sink. In one month 300,000 gallons of water passed through that meter. At one time the supply of water for this premises was taken from a hydrant located in the front yard. Afterwards the hydrant was removed and the pipe extended to the kitchen sink in the building. The pipe from the curb to the hydrant was laid many years ago and was iron. We did not require them to replace the iron pipe with lead, but we did require lead pipe from the location of the hydrant into the building. The leak that caused 300,000 gallons to pass through the meter in one month was located in the iron pipe, which was full of holes. This pipe had probably been leaking for a good many years and the leak was only detected by the placing of the meter.

It would seem that this convention should understand these things thoroughly, and should realize that it is our duty to provide and use the best material obtainable for service pipes, not only for our own protection from waste of water through leakage, but also for the protection of the consumer. In fact, our State Utilities Commission insists that when meters are set on services a thorough test shall be made to see if there are any leaks in the consumer's pipes, and if leaks are found, to notify the owner to make repairs.

We might go on at length with this discussion, and afterwards go home and handle this subject as we think best and to our own benefit. The speaker quite agrees with some of the gentlemen here that plumbers are the poorest lot of mechanics that we have to deal with, but we are up against it, and will have to handle them as best we can; but we should insist on the one point, that all ditches where plumbers are laying service pipes should be left open for inspection before filling in. In some cases plumbers neglect to do this. We then require them before the water is turned on to uncover the pipe.

Mr. J. M. Diven: One reason for using a better quality of pipe to the curb line is to avoid tearing up the streets to make repairs.

Mr. Theodore A. Leisen: Mr. Morgan struck one very important keynote when he referred to the fact that any inspection or any action by any of the departments should undertake to carry with it just as full responsibility of protecting the owner of the premises as it does of protecting the interests of the department represented.

There is no question but that it is desirable for the water department to run all services at least to the curb, and preferably to what is commonly designated as the property or building line. Whether that is done at the expense of the consumer or not, is purely a question of how the revenues are derived. In the final analysis the consumer must pay for that pipe either directly or indirectly; it is just the difference between direct or indirect taxation as applied to general improvement.

If a certain class of pipe is required from the main to the curb the same quality should be continued as far as the department's responsibility goes in the laying of that pipe, and the very small difference in expense would hardly warrant using inferior grades of material, if it is inferior. If it is not inferior, then there is no reason for discrimination between either one side or the other of the curb, the responsibility will have to be assumed by the water department. When the house is built on the property line as is usually the case in the business section, going a foot or two further in to make the connection through the wall to connect with the meter is a small matter; but if the house or store sits back 25 or 30 feet from the street line it necessitates carrying the pipe through a larger amount of private property, and then there might be a serious question brought up as to whether the department should do that or leave it to the owner.

On the question of paying for the services, the speaker might refer to an experience in Louisville, Kentucky, where for a long number of years the services were put into the property line from the main free of cost. Later, after several years, that method was changed and the consumer was charged with the actual cost of the services in each instance. There were some objections raised at first, but owing to the absolute confidence in the board of water commissioners at that time the matter passed over and the public was very well satisfied. Later, after that condition had been in force for about four years, they went back to the old method of putting the services in free. The cost of a $\frac{5}{8}$-inch service in Louisville covering a period of years and taking an average length of from 30 to 32 feet on a $\frac{5}{8}$-inch lead service, was less than $12. It averaged that for several years—between $11 and $12, including the corporation cock, the stop-box at the curb and the lead pipe running from the stop-box into the building line; so that the conditions there would be probably more or less the same as they are in any section of the country where they do not have to blast through rock. With that cost the speaker can hardly see why there would be any excuse for considering any other class of material so far as the expense item is concerned.

A MEMBER: Does $12 cover the cost of replacing the pavement?

MR. THEODORE A. LEISEN: Yes, on an average, that covers everything.

A MEMBER: Is the committee that is investigating wrought iron pipe also investigating the relative desirability of wrought iron pipe as compared with lead pipe?

MR. A. A. REIMER: Our committee has that matter under investigation at the present time. We have been working on that for the past two years.

MR. H. C. HODGKINS: The speaker will look for the results of the committee's work with a great deal of interest. He thinks there is a very widespread mistaken idea as to the relative desirability of the two kinds of pipe. Certainly the information should be very valuable to this Association as superintendents.

MR. B. F. SOUDER: Our department puts in the services and controls the services from the main to the curb. The price of the services is governed according to the width of the street; for instance, the property-owner comes to the water department to order a service, we ask him what size service he wants. By the way, we use tin-lined iron pipe from the main to the curb with the corporation and the tail piece as we call it.

Our charges for street services are as follows:

WATER DEPARTMENT OF ATLANTIC CITY

Price List of Street Services
To take effect February 16, 1909

DIAMETER OF PIPE	¾-INCH	1-INCH	1¼-INCH	1½-INCH	2-INCH
Streets and alleys 25 feet wide and less	$11.00	$14.00	$23.00	$29.00	$40.00
Avenues 30 feet wide	13.50	18.25	25.00	32.50	46.00
Avenues 36 feet wide	14.50	19.75	27.00	36.00	50.00
Avenues 50 feet wide	17.00	24.00	33.00	43.00	59.00
Avenues 75 feet wide	22.00	30.00	40.00	55.00	75.00

Add to above price $2.00 for bitulithic or asphalt streets.

Highway department charge for opening streets in addition to above schedule:

Gravel	$1.10
Macadam	4.90
Brick	19.00
Telford	16.80
Asphalt between Main and New Jersey	23.33
Asphalt between New Jersey and Florida	15.90
Asphalt between Florida and Albany	$23.33
Bitulithic—Atlantic Ave.	25.00
Bitulithic—Virginia, South Carolina, Ocean and Tennessee	32.90
Wooden block	33.90

When they come to the office to order a connection with the main and state the location, we instruct the applicant that he must go into the highway department, take out a permit to open the street and bring that permit back to the water office. We then issue the permit, they paying cash for the service in advance. If the streets are paved with bitulithic, asphalt, brick, macadam or gravel, etc., the cost of opening the street varies; for a gravel street they would have to pay $1.10 to the highway department for a permit to open the street; for macadam, $4.90; for brick, $19; asphalt, between Maine and New Jersey Avenue, $23.33; asphalt, between New Jersey Avenue and Florida Avenue, $15.50; bitulithic on Atlantic Avenue, $25; on Virginia Avenue, South Carolina Avenue, Ocean Avenue, and Tennessee Avenue, $32.90; wooden block, $33.90.

If it is a bitulithic paved street it is harder to open and an extra cost of $2 is added when they pay for the permit for the service. We maintain that service; we don't aim to make anything, but we try not to lose on it.

We use tin-lined pipe that costs us in Atlantic City 40 cents a foot for ¾-inch pipe, and is said to have life everlasting; so that when they come to order a service and say, "Well, it seems to me that is a pretty stiff price," we say to them, "It has life everlasting, and never has to be renewed."

The size of taps is governed according to the size of the building. If it is a large hotel and they want larger than 2-inch we give 4-inch; if they want 3-inch we give them 4-inch instead of 3-inch, because we can put in a 4-inch cast iron service cheaper than we can put in a 3-inch wrought iron service. We don't recommend 3-inch wrought iron for hotels, but we give them cast iron. We control and own the meters. We buy the meters and set them at the curb. The meters are invariably all at the curb. We set them there and the plumber takes the service from there.

We compel the plumbers to take out a license. After the work is completed and they are ready to have the water turned on we send an inspector there who inspects the whole building and sees that the work is all right and everything is tight. Then we turn the water on if they have made an application for water. They pay in advance the minimum rate which is governed according to the number of rooms and fixtures there are in the house.

Small meters are read quarterly; the large meters we read monthly; so that we keep in touch with them. When the meters are read the book is left in the office and is gone over there. If we find that they have used more water during the month than they are allowed by the minimum rate we immediately send them a postal card notifying them that their minimum has been exceeded; that they have used a certain number of cubic feet equivalent to so much money. We send the inspector there, and after we get his report we notify them what the trouble is, and the next month if the inspector goes there and finds that they have not attended to it in accordance with the notice, we shut the water off until they do attend to it. Our minimum rates are as follows:

ATLANTIC CITY WATER DEPARTMENT

Information for Water Consumers

		Cub. feet	*Gals.*
Minimum Rate	$ 5.00 entitles you to	5,555	41,667
	10.00	11,111	83,000
	13.00	14,444	108,333
	18.00	20,000	150,000
	25.00	27,777	208,333
	35.00	38,888	291,667
	50.00	55,555	416,667
	75.00	83,333	625,000

Mr. George Houston: Realizing that we are taking up a lot of time with this discussion, the speaker did not divert any more than necessary or attempt to cover any more ground, but is reminded of a story, in listening to these talks, of the foolish child that stuck its finger on the hot stove and then yelled for somebody to assist it out of its trouble by putting more wood into the fire. It is astonishing how men that have been engaged on water works matters as long as some of these gentlemen have will keep on inviting trouble into their own camp. What excuse is there for water works men to assume that a private or a municipally owned company should take on the responsibility for putting the water plumbing into a man's house. There is no excuse for it on earth. If you assume the control of the plumbing inside of a man's property, and go there and inspect it after it is installed and pronounce it O.K., the next time he comes in to pay a bill that is $5 or $6 higher than it ought to be, on account of leaking pipes or fixtures, what are you going to say? Can you tell that man conscientiously that he has to pay the bill? No. That is the experience of every water works man, no matter whether he is collecting for a private company or a municipal plant. Why, that man will at once tell you, "You have had the plumbing inspected, and you ought to know, or see to it that it is all right." Why should we make it our business to inspect house plumbing. We told a man that came in to pay a bill of $52 for one quarter, when his average bill was $3.75, that we had nothing to do with the plumbing. If you take on responsibility for the plumbing you are holding yourselves responsible for the shortcomings of any job, and you cannot get away from it. Why do you want to invite that trouble upon yourselves all the time? Go home and think it over, and you who have not had experience in that line, think it over good and strong!

Mr. W. F. Wilcox: The speaker had occasion about a year ago to try to tabulate the amount of water that could be accounted for by different plants, and arrived at the conclusion that the average amount of water accounted for by different plants was somewhere in the neighborhood of 75 per cent; that 80 per cent was high, and 85 per cent was excellent; that there were very few plants according to their statements that had accounted for 85 per cent of their water. Below 75 per cent would indicate bad management. The report obtained and the result of all the compilations secured showed the above facts.

Somebody here asked the question about buying pure wrought iron pipe. The speaker seriously doubts if there is enough pure wrought iron pipe made in the United States to supply the demand. The pipe people are spending a great deal of money in maintaining a large laboratory to test their pipe, and they are sending out men to investigate any pipe which fails, because they want that information. It would be wise for every man to determine, taking into account his own conditions, whether he can use lead pipe, lead lined pipe, or wrought iron pipe. It is doubtful whether your committee will get enough reliable data to lay down any hard and fast rule that is going to do for any considerable number of plants.

Mr. Francis C. Hersey: From the last speaker's statements, the percentage of unaccounted-for water was leakage in the mains and perhaps meter under-registration. Is that correct?

Mr. W. F. Wilcox: Yes.

MR. GEORGE HORNUNG: Some forty years ago the speaker became manager of a water works, and the question of accounting for the water pumped and consumed came before him. To do this properly, the water pumped was measured, so as to be able to report not only the actual consumption of water by the city, but also to keep informed on the efficiency of the pumping plant. In this case there was a divided reservoir; in one of the basins was constructed a weir, and the caretaker of the reservoir was taught to use the hook gauge, and when he became proficient in this, weir readings were taken daily between the hours of twelve and one o'clock. At the same time and hour, counter readings were taken of the revolutions made by the engine. These weir readings and revolutions of engines were sent to the speaker daily, and the computed results from this data showed that the per capita consumption did not exceed 30 gallons per day.

About twelve years ago the speaker again became the manager of this plant, and upon that occasion the city was about to issue bonds for the purchase of additional pumping machinery. From a preliminary investigation of the machinery it was found to be large enough, if put in thorough repair, to amply supply the city for years to come. For ascertaining the amount of water the engines were pumping in the condition they were in, a Venturi meter was placed in the pipe through which the engines were pumping, and the results obtained indicated that the loss of pump action or slippage was 50 per cent. After the repairs were made meter measurements of the water discharged by the pumps were again taken, which gave a loss of pump action of a fraction less than 3 per cent.

The water consumption per capita, as usually published in the annual water works reports, is generally based on plunger displacement of the pump, with a small correction for pump slippage, which cannot be relied upon, for reasons as heretofore stated, unless the water delivered by the pumps is actually measured. As an illustration of the unreliability of the method of reporting the water delivered by a pumping engine when based on plunger displacement, the following instance may be cited: in the investigation of a large pumping station an engine with a rated capacity of 24,000,000 gallons per day, was found operating for two weeks without pumping any water; or in other words the slippage or loss of pump action in this case, was equal to 100 per cent; but with all that, the daily reading of the counter on the engine, and its computed plunger displacement, was sent by the chief operating engineer to the office of the superintendent of that water works, and there accepted without being questioned in entering it up with the remaining engines in operation as water pumped and consumed. The discharge pipe or force main of this engine approached the reservoir on a uniform ascending grade, and finally curved vertically, with its end flush with the bottom of a large flume constructed of masonry alongside of the reservoir, through which the water was led to the latter. Into this flume six other engines were delivering their water at one time; hence the failure of this particular engine went undiscovered until all of the others were shut down and this one operated by itself.

MR. WIRT J. WILLS: Mr. President and gentlemen, inasmuch as this discussion has covered almost the entire life history of every other water department it had better get a look-in now relating to the conditions in Memphis, which has been a municipally owned plant. The connection from the main to the curb is paid for by the city and put in by the water department. The city has a plumbing inspector who inspects the plumbing inside of the building.

MR. W. F. WILCOX: Mr. Hornung took up the question of pump slippage as affecting unaccounted-for water. The speaker cannot see how anybody would carry pump slippage over into that account. Any man with a very rough apparatus can find out what his pump slippage is.